

What is claimed:

1. A process to produce aqueous hydrocarbon fuel comprising
5 emulsifying components comprising:
 - (A) a liquid hydrocarbon fuel;
 - (B) at least one emulsifier, wherein the emulsifier comprises:
 - (i) at least one fuel-soluble product made by reacting at least one
hydrocarbyl-substituted carboxylic acid acylating agent with ammonia or an amine,
10 the hydrocarbyl substituent of said acylating agent having about 50 to about 500
carbon atoms;
 - (ii) at least one of an ionic or a nonionic compound having a
hydrophilic-lipophilic balance (HLB) of about 1 to about 40;
 - (iii) a mixture of (ii) with (i);
 - 15 (iv) a water-soluble compound selected from the group consisting of
amine salts, ammonium salts, azide compounds, nitrate esters, nitramine,
nitrocompounds, alkali metal salts, alkaline earth metal salts, in combination with
(i), (ii), (iii), (v), (vii) or combinations thereof;
 - (v) the reaction product of polyacidic polymer with at least one fuel
20 soluble product made by reacting at least one hydrocarbyl-substituted carboxylic
acid acylating agent with ammonia, an amine, a polyamine, or hydroxy alkyl
amines;
 - (vi) an amino alkylphenol which is made by reacting an alkylphenol,
an aldehyde and an amine, resulting in an amino alkylphenol; or
 - 25 (vii) the combination of (vi) with (i), (ii), (iii), (iv), (v) or
combinations thereof;
 - (C) a reactant emulsion comprising a water in oil emulsion of a liquid
hydrocarbon and at least one emulsifier wherein the liquid hydrocarbon fuel and at
least one emulsifier are selected from the group of the same, similar, or different
30 liquid hydrocarbon fuel than the one used in step (A) and at least one emulsifier
disclosed in step B; and

(D) a water mixture selected from the group comprising water, water antifreeze, water ammonium salt, water antifreeze ammonium nitrate mixture, and combinations thereof,

5 under emulsification conditions wherein the ratio of hydrocarbon fuel, emulsifier and water to reactant emulsion is in the range of about 1% to about 99% by weight hydrocarbon fuel, emulsifier and water to about 99% to about 1% by weight reactant emulsifier and wherein the emulsification shear rate results in an emulsion having a particle size having a mean diameter of less than 1.0 micron.

10 2. The process of claim 1 wherein the resulting emulsion has a particle size having a mean diameter in the range of about 1.0 micron to about 0.1 micron.

3. The process of claim 1 wherein about 50% to about 90% by weight of the hydrocarbon fuel, about 0.1% to about 25% by weight of the emulsifier, about
15 1% to about 90% by weight of the reactant emulsion, and about 1% to about 90% by weight of the water, wherein the water contains about 0% to about 10% by weight of water-soluble additives are added to a vessel and wherein the ratio of hydrocarbon fuel, emulsifier and water to reactant emulsion is about 50% by weight hydrocarbon fuel, emulsifier and water to about 50% by weight reactant emulsion.

20 4. The process of claim 3 wherein the ratio of hydrocarbon fuel, emulsifier and water to reactant emulsion is about 40% to about 60% by weight hydrocarbon fuel, emulsifier and water to about 60% to about 40% by weight reactant emulsion.

25 5. The process of claim 3 wherein the ratio of hydrocarbon fuel, emulsifier and water to reactant emulsion is about 15% to about 85% by weight hydrocarbon fuel, emulsifier and water to about 85% to about 15% by weight reactant emulsion.

30 6. The process of claim 1 wherein the emulsifier is selected from the group consisting of a water-soluble compound selected from the group consisting of

amine salts, ammonium salts, azide compounds, nitrate esters, nitramine, nitrocompounds, alkali metal salts, alkaline earth metal salts, in combination with (iii).

5 7. The process of claim 6 wherein the water-soluble compound is ammonium nitrate.

8. The process of claim 1 wherein the components are emulsified in a batch process for about 1 to about 20 tank turnovers at a temperature in the range of
10 about ambient temperature to about 212°F and at a pressure in the range of about atmospheric to about 10 atmospheres, resulting in a stable aqueous hydrocarbon fuel emulsion.

9. The process of claim 1 wherein the process is a continuous process
15 and wherein the feeds of hydrocarbon fuel, emulsifier, reactant emulsion and the water are introduced as feeds selected from the group consisting of discrete feeds and combinations of discrete feeds and combinations thereof to form a homogeneous aqueous hydrocarbon fuel emulsion and wherein the process occurs at a temperature in the range of ambient temperature to about 212°F and at a pressure in the range of
20 about atmospheric pressure to about 500 psi.

10. The process of claim 1 wherein the emulsification occurs at a shear rate in the range of greater than 0 s^{-1} to about $500,000 \text{ s}^{-1}$ of shearing.

25 11. The process of claim 1 wherein the emulsification occurs at a shear rate in the range of about $20,000 \text{ s}^{-1}$ to about $200,000 \text{ s}^{-1}$ shearing.

12. The process of claim 1 wherein the emulsification occurs at a shear rate in the range of $25,000 \text{ s}^{-1}$ to about $125,000 \text{ s}^{-1}$ of shearing.

30 13. The process of claim 8 wherein at least one to five emulsification steps in series is employed in the continuous process.

14. The process of claim 9 wherein at least one to five emulsification steps in series is employed in the continuous process.

5 15. The process of claim 13 wherein there is no aging of the hydrocarbon fuel water emulsion between each emulsification step.

16. The process of claim 14 wherein the emulsion flows from one emulsification step to the next emulsification step in less than 5 minutes.

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17. The process of claim 14 wherein the emulsion flows from one emulsification step to the next emulsification step in less than 3 minutes.

18. The process of claim 14 wherein the emulsion flows from one emulsification step to the next emulsification step in less than 1 minute.

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19. The process of claim 14 wherein the emulsion flows from one emulsification step to the next emulsification step in less than 30 seconds

20. The process of claim 9 wherein the reactant emulsion is formed from recycling the emulsion hydrocarbon fuel emulsion made in a continuous process.

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21. The process of claim 8 wherein the reactant emulsion is formed from recycling the emulsion hydrocarbon fuel made in a batch process.

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22. The process of claim 1 wherein the reactant emulsion comprises about 50% to about 99% by weight hydrocarbon fuel and about 0.05% to about 25% by weight of at least one emulsifier.

23. The process of claim 1 wherein the reactant emulsion is selected from the group that is the same, similar or different emulsion than the aqueous hydrocarbon fuel.

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